

# **Appendices**

## **Valkyrie**

Appendix 1 - Gantt Chart for Research Programme

Appendix 2 - Evaluation Feedback from Dissemination  
Event 19 March 2014

Appendix 3 - First Draft Mechanical Aptitude  
Assessment

Appendix 4 - Evaluation form for Tutors

Appendix 5 Final Mechanical Aptitude Assessment

Appendix 6 - Evaluation form for Employers & Results

Appendix 7 - Evaluation form for Learners & Results

## Appendix 1 - Gantt Chart for Research Programme

Sue Morgan	Who	2014 Research Project – To evaluate the effectiveness of a revised initial assessment tool which is contextualised for the engineering sector																											
Key project activities		Feb				Mar				Apr				May				June				July							
1 Complete overview of Engineering Initial Assessment	DW																												
2 Present initial assessment at the Northampton event	DW/SM																												
3 Gather feedback from the employers about the initial assessment	SM																												
4 Tweek initial assessment from the feedback received from employers																													
5 Pilot initial assessment for 6 learners																													
6 Feedback required from learners about the new initial assessment – survey monkey?																													
7 Interview learners about the initial assessment – qualitative																													
8 Interview tutors about the initial assessment - qualitative																													
9 Interview employer about the initial assessment - qualitative																													
10 Complete report and submit																													

Sue Morgan	Who	2014 Research Project – Design and pilot a mechanical aptitude initial assessment which is contextualised to the engineering sector.																											
Key project activities		Feb				Mar				Apr				May				June				July							
1 Design a mechanical aptitude initial assessment	RH																												
2 Create an evaluation form for tutors and send it to them	SM																												
3 Gather feedback from the 3 tutors about the initial assessment	SM																												
4 Create an evaluation form for employers and learners	SM																												
5 Pilot initial assessment on 6 learners and gather feedback	DW																												
6 Gather feedback from employers about the initial assessment	DW																												
7 Complete the research report using a storyboard format	SM																												
8 Check and send over to Joss Kang	SM																												

## Appendix 2 - Evaluation Feedback from Dissemination Event 19 March 2014



# Evaluation form

## Dissemination event

19 March 2014

## Northampton Enterprise Partnership

We appreciate you taking the time to complete this evaluation. The honest and constructive feedback you provide helps us review our current provision and identify areas for improvement to ensure we provide the best quality service possible.

### Objectives

	Fully achieved	Partially achieved	Not achieved
How would you assess that the aims and objectives of the session were achieved?	1	7	

### How would you rate the:

	Very good	Good	Satisfactory	Poor
session in <b>meeting your expectations</b>	1	4	3	
opportunities for involvement and participation?	1	5	1	
subject knowledge of the trainer/facilitator/speaker?	1	5		

### How would you assess the:

<b>new ideas/approaches/strategies</b> for improving your area of work?	2	2	4	
appropriateness of the session's content	1	3	4	
quality and performance of the trainer/facilitator/speaker?	1	6		

What is your <b>overall assessment</b> of the session?	1	7		
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## COMMENTS

To what extent did the resources meet the needs of your organisation?

1. blank
2. blank
3. Raised awareness of apprenticeship levels and apprenticeship standards!
4. Good to see the focus on mathematics.
5. Some were useful. I really liked the assessment tool which I would use.
6. Not really for my specific company as I don't employ apprentices but I am very interested with respect to the engineering sector in Northamptonshire.
7. Partially – most already covered by SEMTA service.
8. Good look into the industry behind the apprentice's worked with.

What changes would you like to see in the assessment tool?

1. Reduced in complexity.  
Assess – reasoning skills, mathematics/English, dexterity/mechanical aptitude. Three module test.
2. Can assessment tool be made available to employers?
3. To be on-line!
4. On-line and more varied practical tests.
5. I would like more time to assess before saying.
6. Questions need to be pitched at the right level (also high enough) as local employers can be quite selective in who they employ. Will be looking at 'A level' intake not just GCSE.
7. On-line assessment (but we already have this with SEMTA).
8. Open availability. Like module approach so can be used individually.

What changes would you like to see in the trigonometry course?

1. More relevant to engineering applications. On-line access would be the preferred route.
2. None but made available to all.
3. Practical examples!
4. From what was shown today, on-line would increase accessibility.
5. The course looked good, however im not sure that trigonometry is the area of need with our apprentices. However if it is your course looked good. The idea of an 'app' would be useful as it's the way of the future.
6. Need industry related projects and also needs to be at the appropriate level not just the basics. Content should be driven by employer requirements including both large and small employers.
7. Application to our business environment. Open access workshops we can send our apprentices to.
8. So it can be used to up-skill people to enable to move into the industry with better knowledge of this element.

## Appendix 3 - First Draft Mechanical Aptitude Assessment

*Engineering Disciplines*

**INITIAL ASSESSMENT**

*Mechanical Aptitude*





## Mechanical Aptitude

A person's Mechanical Aptitude is their ability to recognise which mechanical principle is suggested by a test item. The underlying concepts measured by these items include sound and heat conduction, velocity, gravity and force.

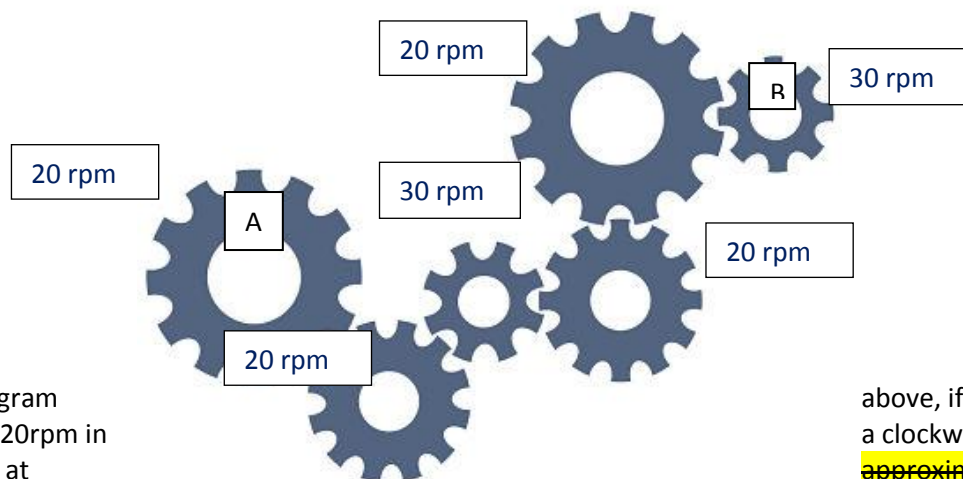
Traditionally a Mechanical Aptitude Test will show you a diagram and then ask you to apply a mechanical principle in order to determine an outcome. However, in the process of applying a mechanical principle there are usually several stages, or steps, of reasoning involved. It is therefore sensible to consider partial success – therefore this initial assessment offers:

- A single “model” answer to a question
- Some “partial success” answers to a question which show an ability to apply mechanical principle even though the end answer might be incorrect
- Incorrect answers

Throughout the assessment, for every question, the learner will achieve zero, one or two marks depending on the strength of their answer.

### Initial Assessment Questions

#### Question 1



In the diagram moves at 20rpm in direction, at what speed will what direction?

above, if gear A a clockwise approximately gear B turn and in

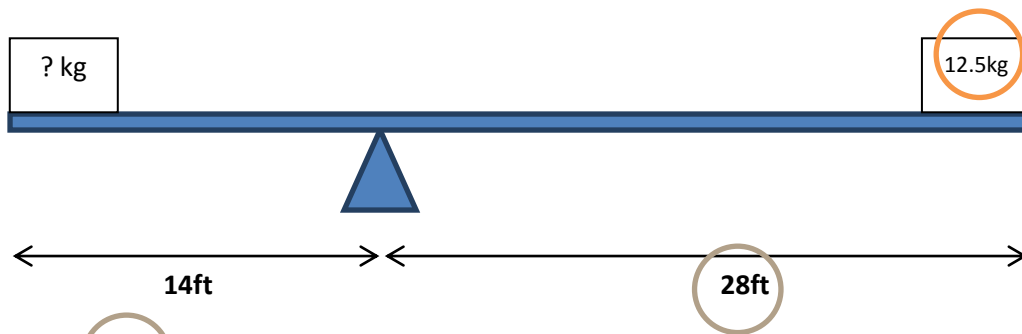
Direction \_\_\_\_\_ anticlockwise \_\_\_\_\_

Speed \_\_\_\_\_ 30 rpm \_\_\_\_\_

**Speed of gears is calculated by the ratio of the number of teeth on each wheel.**

**It is unlikely that the candidates will know how to calculate gear velocity ratios, therefore it may be better to just ask for the direction of rotation.**

### Question 2



How many pounds would the box on the left need to weigh in order to balance the plank on the fulcrum?

**Units are mixed ft; pounds; Kg**

Weight \_\_\_\_\_ 25 \_\_\_\_\_

### Question 3



**All of these tools are woodworking tools therefore not contextualised to engineering.**

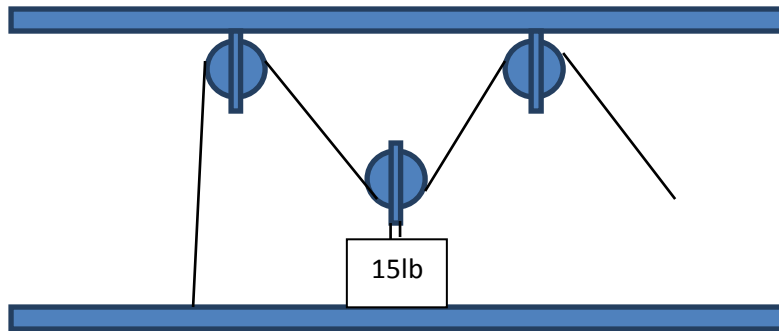
Which of the above items, alone, would be able to deliver the greatest amount of pressure to a surface at a single moment in time? Explain why.

**Force?**

Item \_\_\_\_\_

Reason why \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

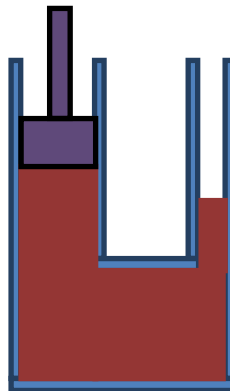
#### Question Four



How much weight needs to be applied to the loose line to the right in order to lift the weight off the ground?

Weight \_\_\_\_\_ **7.5 lb** \_\_\_\_\_

#### Question Five



I would suggest that we give more specific information about the size of the tubes. Such as; if the piston on the left is three times the diameter of the tube on the right; etc

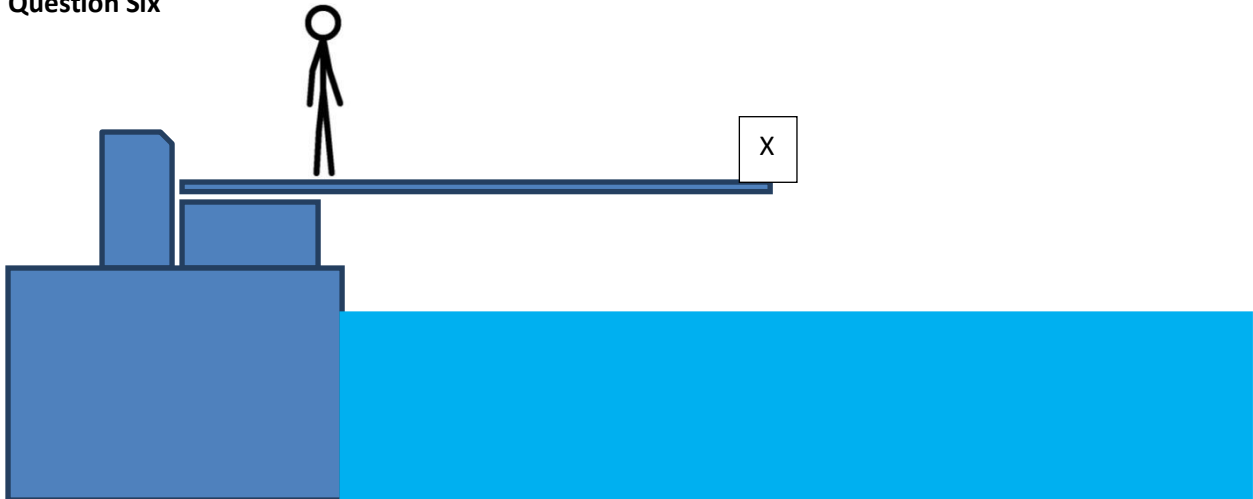
The diagram above represents cylindrical tubing holding a thin oil lubricant. If the diagram IS to scale and the piston shown to the left is pushed down by 1cm – approximately how many cm will the liquid rise up the tube to the right?

What problems could occur which might stop this system from working properly? Give ONE example.

Distance raised \_\_\_\_\_

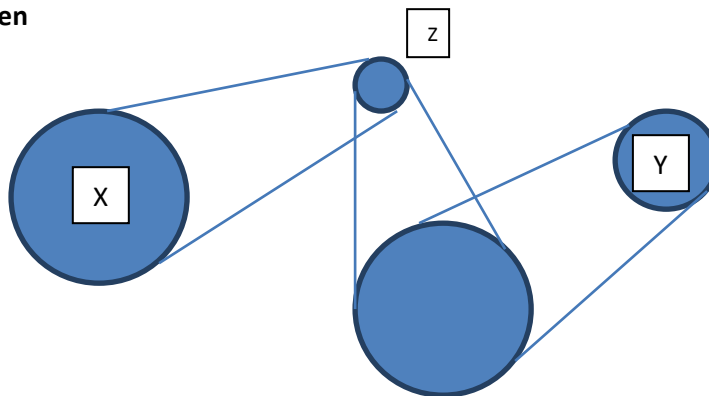
Reason for failure \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

### Question Six



On the diagram above please draw an X to indicate the point on the diving spring board where the diver would be able to generate the maximum lift by jumping up and down and then springing from the board.

### Question Seven



In the diagram above the four gears are connected by belts. All of the gears are driven by a motor attached to Gear Z. If Gear X revolves at 3000rpm in a clockwise direction, what will be the speed and direction of Gear Y?

Speed of Gear Y \_\_\_\_\_

Direction of Gear Y \_\_\_\_\_

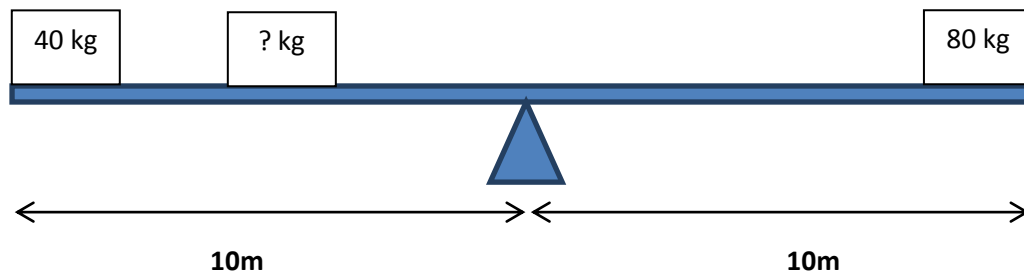
**Gears are in contact with each other and not driven by belts, it would be more appropriate to describe these as belts and pulleys.**

**I suggest we make X the driver and give it a value of say 3000 rpm and a diameter of 500 mm, Z would be 100mm the un-named pulley would be 650mm and Y would be 200mm;**

**What is the resulting speed of Y?**

**Answer; speed =  $3000 \times 500/100 = 15000 \times 100/650 = 2308 \times 650/200 = 7501\text{rpm}$**

### Question Eight

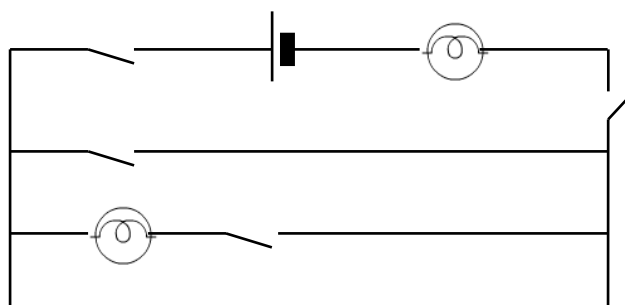


The plank shown above, which supports the weights is balanced perfectly on the fulcrum. State the **approximate** weight of the middle box.

Weight \_\_\_\_\_

**Given that the middle box is half way or 5m, I make this 80kg?**

### Question Nine



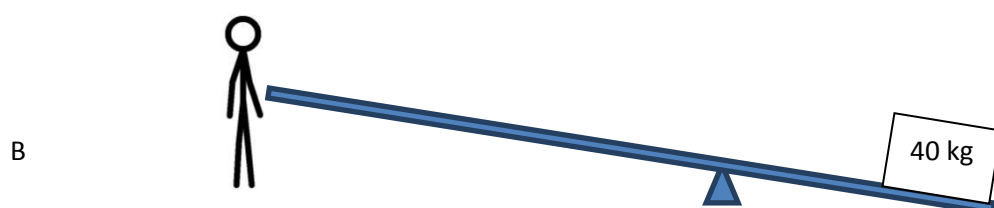
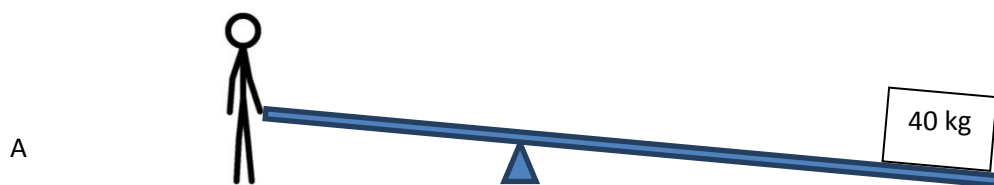
In the circuit diagram shown above – how many switches would need to be closed in order to cause just one of the bulbs to light?

Number of switches \_\_\_\_\_ **2** \_\_\_\_\_

How many switches would need to be closed in order for both bulbs to be lit?

Number of switches 3

## Question Ten



In which of the diagrams above does the operator need to apply the *least* force in order to raise the box from the ground?

Diagram Letter B

If the force required in Diagram A is 80kg, approximately how much force would be required in Diagram B?

**We need to know the positions of the fulcrum to be able to calculate this**

Approximate force \_\_\_\_\_

### Marking Section (Tutor Only)

Question	S2	S1	Question	S2	S1
1			6		
2			7		
3			8		
4			9		
5			10		
<b>Total</b>					

## Mechanical Aptitude Assessment Marking Scheme

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### Question One

**2 Points** Anticlockwise, 40 rpm (accept from 35 rpm to 45 rpm) **How is this calculated?**

**1 Point** For stating Anticlockwise OR stating the speed at 30rpm or more

**Otherwise Score 0 Points**

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### Question Two

**2 Points** Exactly 25 kg

**1 Point** For any answer from 18kg to 40kg (identifies that the box would need to weigh significantly more)

**Otherwise Score 0 Points**

---

### Question Three

**2 Points** Learner identifies the claw hammer for the reason that the greatest amount of pressure is generated by the item which can inflict the greatest *weight* of impact at a single point in time, yet over the *smallest* surface area.

**1 Point** The learner identifies any of the following:

Claw hammer – with a partly correct attempt to explain why

Nail – explaining the correct concept but not realising that the nail cannot be applied without a driving force

Drill – explaining the correct concept but not realising that the drill applies pressure evenly over a period of time and not in a single impact

**Otherwise Score 0 Points**

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### Question Four

**2 Points** Exactly 7.5lbs – or 7 pounds, 8 ounces

**1 Point** Any weight from 5 to 10 pounds

**Otherwise Score 0 Points**

---

**Not necessarily true, it would still work with water or grease**  
**Suggest the oil may be contaminated.**

**Question Five**

**2 Points** Between 2.5 and 3.5 cm and one of the following reasons given:

- Oil might not be viscous enough – could be too thick therefore making it too difficult to depress the piston
- The piston might not seal to the inside of the tube, resulting in leaks to the sides

**1 Point** Recognises that the liquid **will rise more quickly** – more than 1cm and gives a reason which is broadly the same as either of the above but perhaps explained inaccurately or inarticulately

**Otherwise Score 0 Points**

---

**Question Six**

**2 Points** The X is positioned right at the end (but not over the end) of the board

**1 Point** The X is positioned toward the end of the board, within 1 cm from the end

**Otherwise Score 0 Points**

---

**Question Seven**

**2 Points** 5000rpm to 7000rpm and clockwise

**1 Point** Between 4000rpm and 8000rpm and/or clockwise

**Otherwise Score 0 Points**

---

**Question Eight**

**2 Points** Exactly 40 kg **How is this calculated?**

**1 Point** For any answer from 30kg to 50kg

**Otherwise Score 0 Points**

---

**Question Nine**

**2 Points** Two and Three

**1 Point** Any one of the above two answers is correct



Otherwise Score 0 Points

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Question Ten

**2 Points**      Diagram B and between 18kg and 22kg **20kg?**

**1 Point**      Diagram B and somewhere between 10kg and 30kg

Otherwise Score 0 Points

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## Appendix 4 - Evaluation form for Tutors

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## Initial Assessment

### Engineering Disciplines for Mechanical Aptitude

#### Evaluation form for tutors

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Please complete the following questions to give us feedback and help us to review the new initial assessment for Mechanical Aptitude.

The initial assessment tool has been contextualised for the engineering sector in order to gain a more accurate assessment of the learners' abilities.

Please circle from 1 = Strongly agree, 2 = Agree, 3 = Don't know, 4 = Disagree, 5 = Strongly disagree

- |   |           |
|---|-----------|
| 1. The layout of the initial assessment is appropriate and fit for purpose.                           | 1 2 3 4 5 |
| 2. The diagrams/illustrations are correctly presented.  | 1 2 3 4 5 |
| 3. Learners will understand the diagrams?   | 1 2 3 4 5 |
| 4. Were the questions appropriate?  | 1 2 3 4 5 |
| 5. Are the questions challenging but not too difficult for prospective apprentices?                   | 1 2 3 4 5 |
| 6. How well will it assess initial capabilities?  | 1 2 3 4 5 |
| 7. Could you easily mark/score the assessment?  | 1 2 3 4 5 |
| 8. The scoring system is appropriate?   | 1 2 3 4 5 |
| 9. A computerised version of the initial assessment would be appropriate and provide reliable results | 1 2 3 4 5 |

Are there any changes you would make, please list?

Please add any further comments:

Thank you for your feedback - Sue

## Appendix 5 Final Mechanical Aptitude Assessment

*Engineering Disciplines*

## ***INITIAL ASSESSMENT***

### ***Mechanical Aptitude***



**Mechanical Aptitude**

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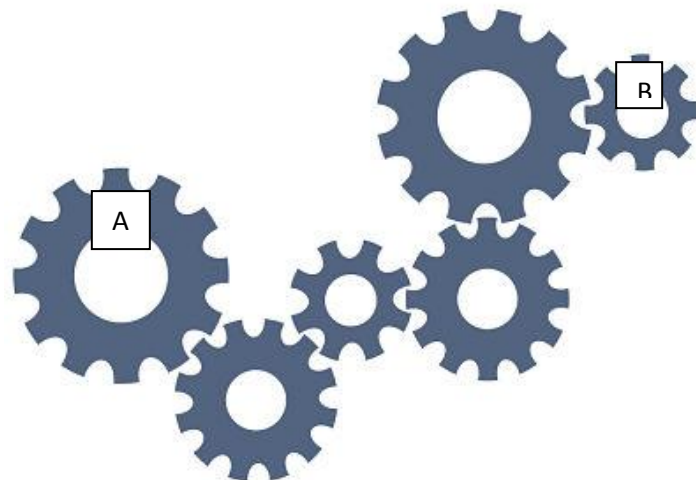
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- A single “model” answer to a question
- Some “partial success” answers to a question which show an ability to apply mechanical principle even though the end answer might be incorrect
- Incorrect answers

Throughout the assessment, for every question, the learner will achieve zero, one or two marks depending on the strength of their answer.

### Initial Assessment Questions

#### Question 1



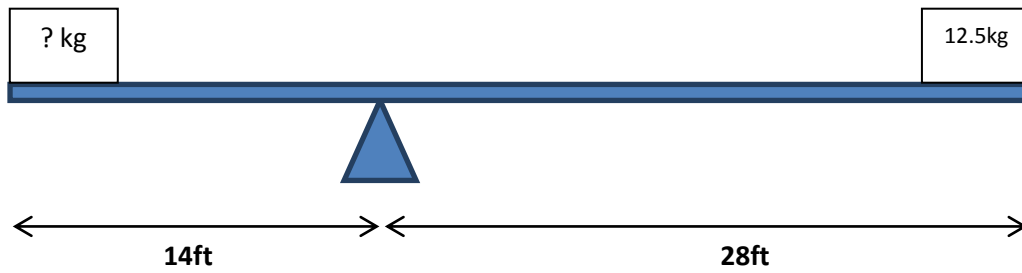
In the diagram  
moves at 20rpm in  
direction, at  
what speed will  
what direction?

above, if gear A  
a clockwise  
approximately  
gear B turn and in

Direction \_\_\_\_\_

Speed \_\_\_\_\_

#### Question 2



How many pounds would the box on the left need to weigh in order to balance the plank on the fulcrum?

Weight \_\_\_\_\_

### Question 3

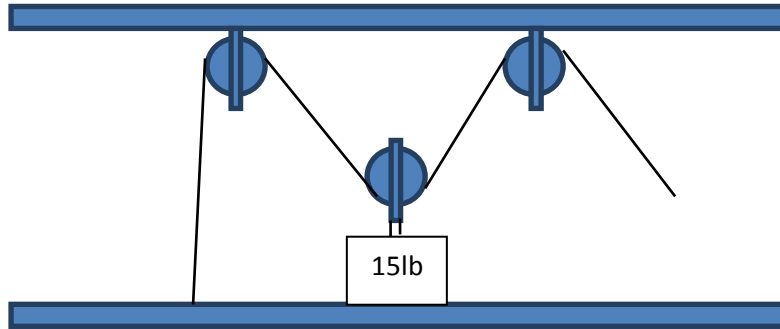


Which of the above items, alone, would be able to deliver the greatest amount of pressure to a surface at a single moment in time? Explain why.

Item \_\_\_\_\_

Reason why \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

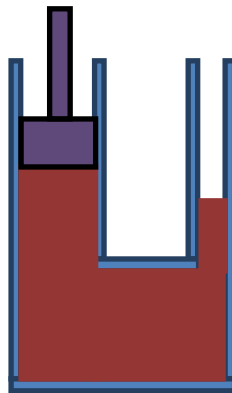
### Question Four



How much weight needs to be applied to the loose line to the right in order to lift the weight off the ground?

Weight \_\_\_\_\_

#### Question Five



The diagram above represents cylindrical tubing holding a thin oil lubricant. If the diagram IS to scale and the piston shown to the left is pushed down by 1cm – approximately how many cm will the liquid rise up the tube to the right?

What problems could occur which might stop this system from working properly? Give ONE example.

Distance raised \_\_\_\_\_

Reason for failure \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

#### Question Six

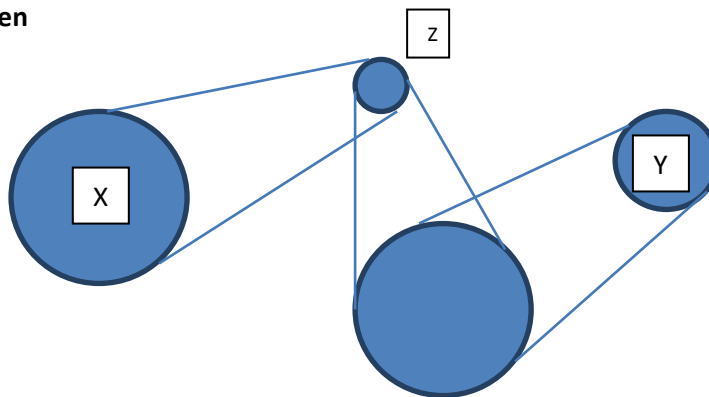






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#### Question Seven

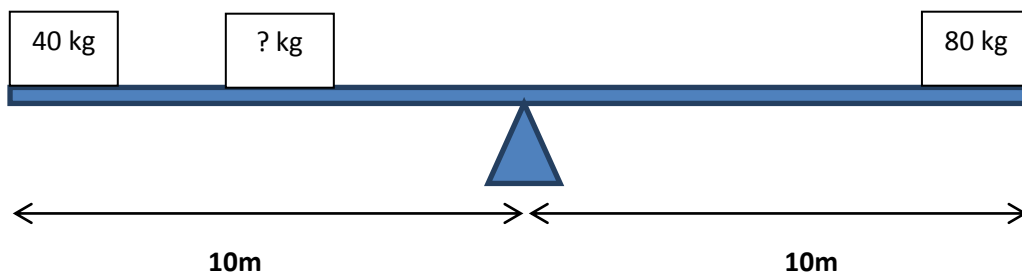


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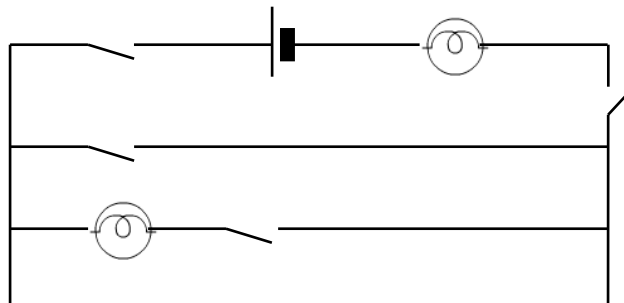
#### Question Eight



The plank shown above, which supports the weights is balanced perfectly on the fulcrum. State the approximate weight of the middle box.

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#### Question Nine



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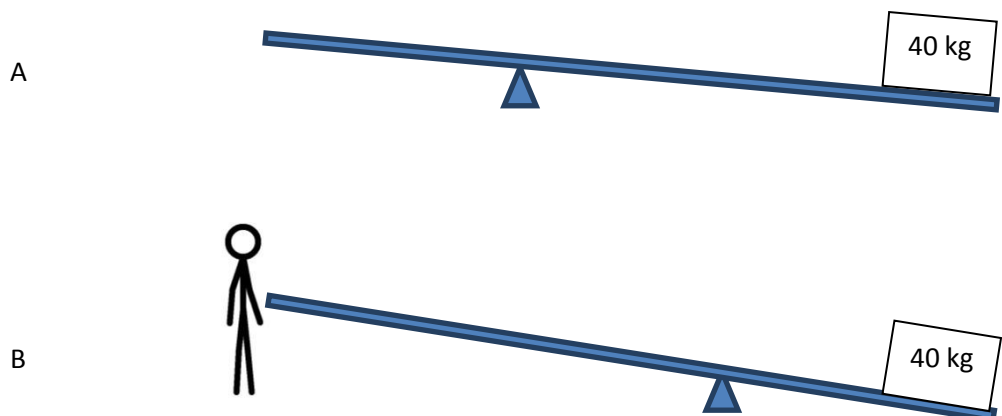
Number of switches \_\_\_\_\_

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Number of switches \_\_\_\_\_

#### Question Ten





In which of the diagrams above does the operator need to apply the *least* force in order to raise the box from the ground?

Diagram Letter \_\_\_\_\_

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Approximate force \_\_\_\_\_

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2			7		
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5			10		
<b>Total</b>					

### Question One

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---

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**2 Points** Exactly 25 kg

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---

### Question Three

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**Otherwise Score 0 Points**

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### Question Four

**2 Points** Exactly 7.5lbs – or 7 pounds, 8 ounces

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### Question Five

**2 Points** Between 2.5 and 3.5 cm and one of the following reasons given:

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#### Question Eight

**2 Points** Exactly 40 kg

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**Otherwise Score 0 Points**

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#### Question Nine

**2 Points** Two and Three

**1 Point** Any one of the above two answers is correct

**Otherwise Score 0 Points**

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#### Question Ten

**2 Points** Diagram B and between 18kg and 22kg

**1 Point**      Diagram B and somewhere between 10kg and 30kg

**Otherwise Score 0 Points**

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## Appendix 6 - Evaluation form for Employers & Results

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Initial Assessment

Engineering Disciplines for Mechanical Aptitude

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## Evaluation form for employers

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Please complete the following questions to give us feedback and help us to review the new initial assessment for Mechanical Aptitude.

The initial assessment tool has been contextualised for the engineering sector in order to gain a more accurate assessment of the learners' abilities.

Please circle from 1 = Strongly agree, 2 = Agree, 3 = Don't know, 4 = Disagree, 5 = Strongly disagree

- |   |           |
|---|-----------|
| 1. The layout of the initial assessment is appropriate and fit for purpose.                           | 1 2 3 4 5 |
| 2. The diagrams/illustrations are correctly presented.  | 1 2 3 4 5 |
| 3. Learners will understand the diagrams?   | 1 2 3 4 5 |
| 4. Were the questions appropriate?  | 1 2 3 4 5 |
| 5. Are the questions challenging but not too difficult for prospective apprentices?                   | 1 2 3 4 5 |
| 6. How well will it assess initial capabilities?  | 1 2 3 4 5 |
| 7. Could you easily mark/score the assessment?  | 1 2 3 4 5 |
| 8. The scoring system is appropriate?   | 1 2 3 4 5 |
| 9. A computerised version of the initial assessment would be appropriate and provide reliable results | 1 2 3 4 5 |

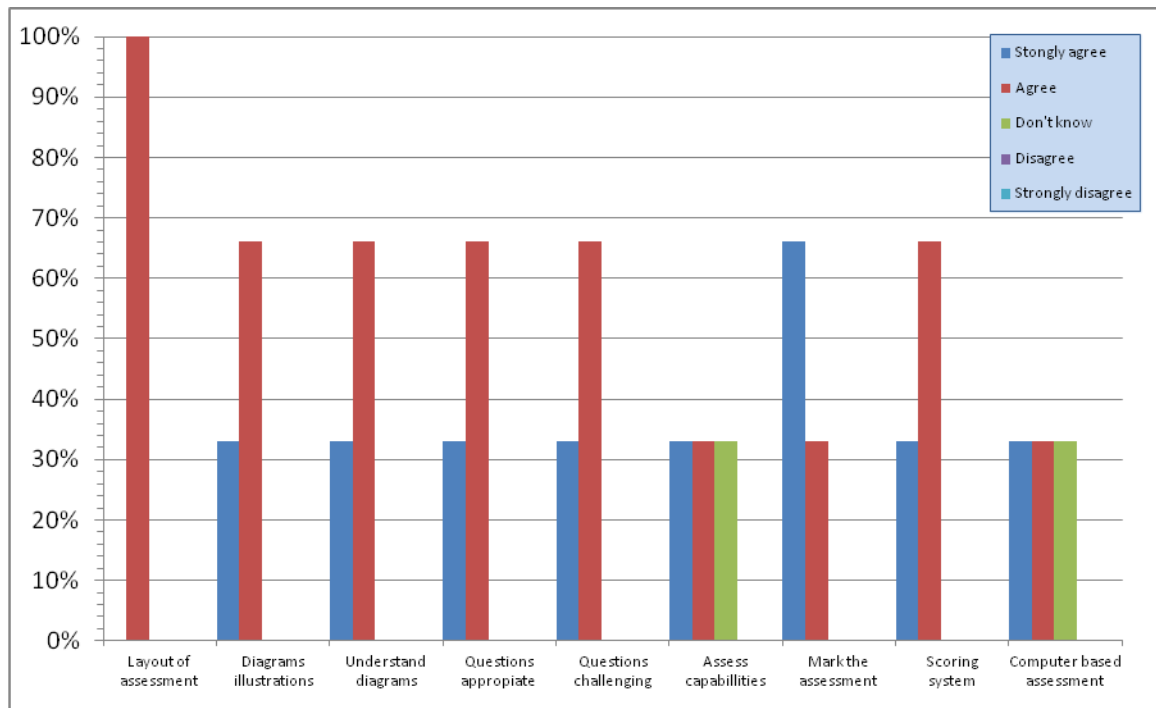
Are there any changes you would make, please list?

Please add any further comments:

Thank you for your feedback - Sue

## Feedback from employers





3 employers completed the questionnaire out of a total of 6 which equates to a 50% response rate

## Appendix 7 - Evaluation form for Learners & Results

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Initial Assessment

Engineering Disciplines for Mechanical Aptitude

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## Evaluation form for learners

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Please complete the following questions to give us feedback and help us to review the new initial assessment for Mechanical Aptitude.

The initial assessment tool has been contextualised for the engineering sector in order to gain a more accurate assessment of the learners' abilities.

Please circle from 1 = Strongly agree, 2 = Agree, 3 = Don't know, 4 = Disagree, 5 = Strongly disagree

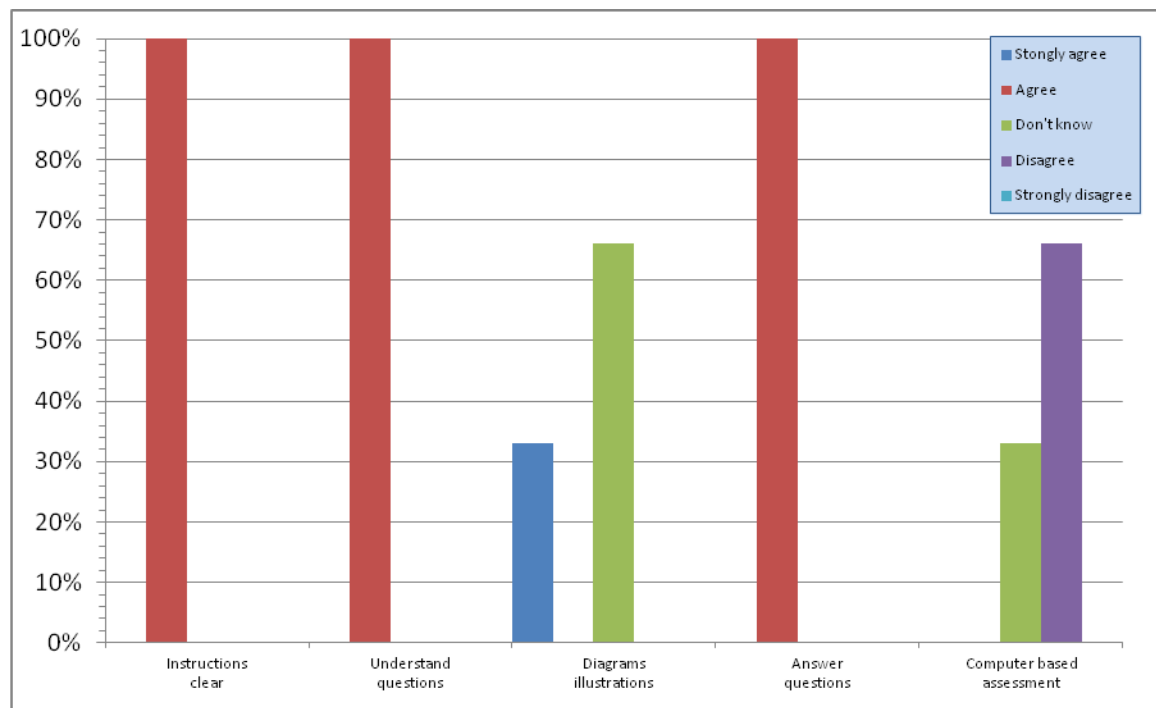
- |   |           |
|---|-----------|
| 1. The instructions explaining how to use the initial assessment are clear.                       | 1 2 3 4 5 |
| 2. I understand what is being asked of me in each question.                                       | 1 2 3 4 5 |
| 3. The diagrams and illustrations help me to answer the questions.                                | 1 2 3 4 5 |
| 4. The examples used in the questions are relevant to my role or workplace.                       | 1 2 3 4 5 |
| 5. I feel confident that I can answer the questions to the best of my ability.                    | 1 2 3 4 5 |
| 6. A computerised version of the initial assessment would be better than the paper-based version? | 1 2 3 4 5 |

How do you think Valkyrie could improve the questions?

Please add any further comments:

Thank you for your feedback -

**Feedback from learners**



3 employers completed the questionnaire out of a total of 6 which equates to a 50% response rate